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(56) Documents Cited  
GB 2161196 A GB 1240507 A EP 0103048 A  
FR 000250118 A US 4282687 A

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(54) Abstract Title

Doors and door assemblies

(57) A door leaf has a pair of outer panels (6) supported by a perimeter frame (5). At least one of the panels is composed of two or more layers (9,10). One layer (9) is of a metal material and one layer (10) is of a non-metal material. Preferably the metal layer (9) is an internal layer and the non-metal layer (10) is an external layer. The metal layer (9) can be of a size such that it fits into the frame (5) whilst the non-metal layer (10) overlaps at least partially with the frame (10) and can be fixed to the frame (10) with an adhesive.

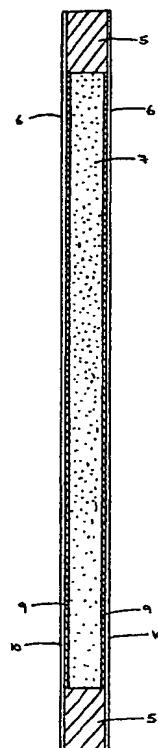


Fig. 3

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

GB 2 349 163 A

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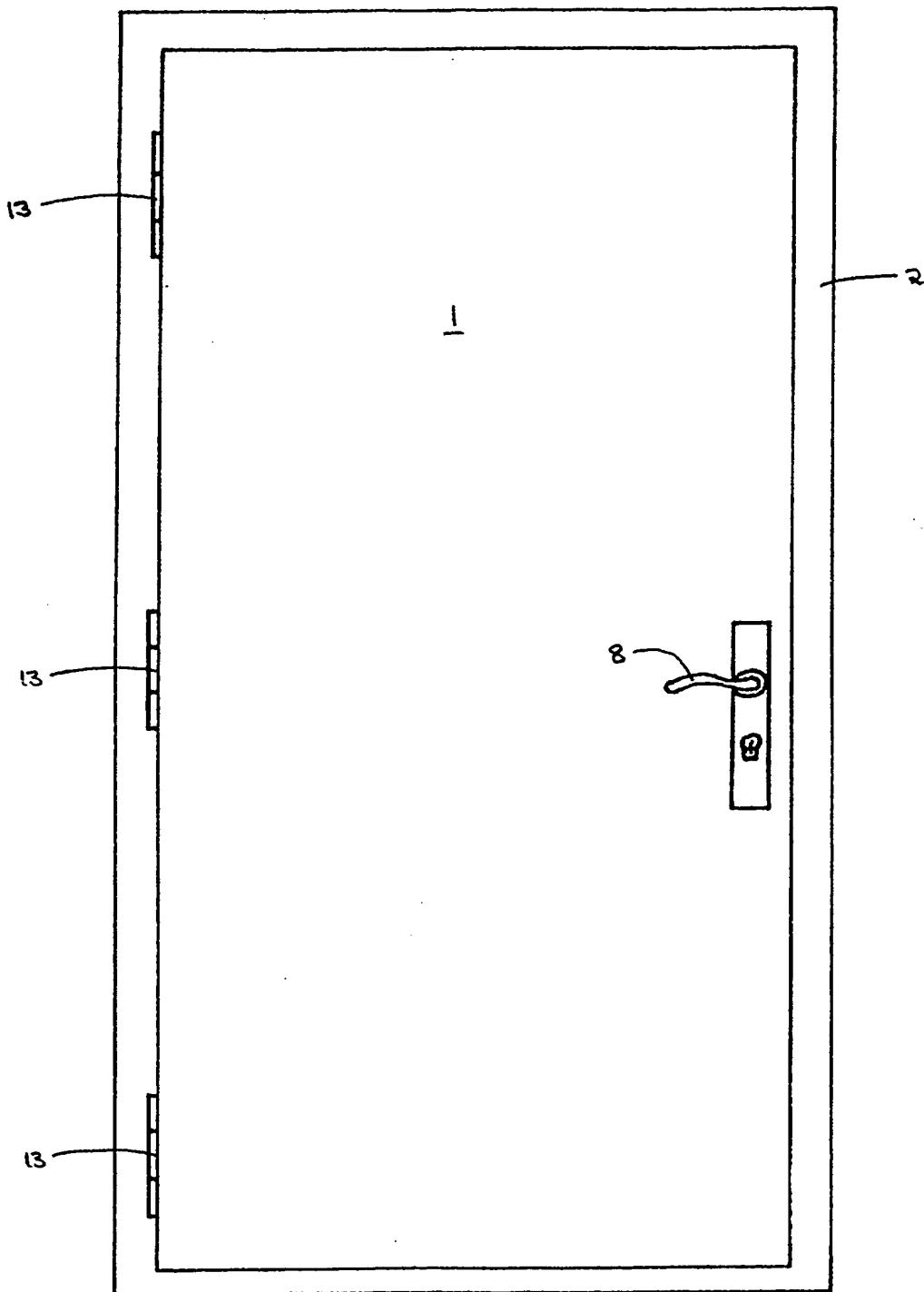


FIG. 1

2 | 3

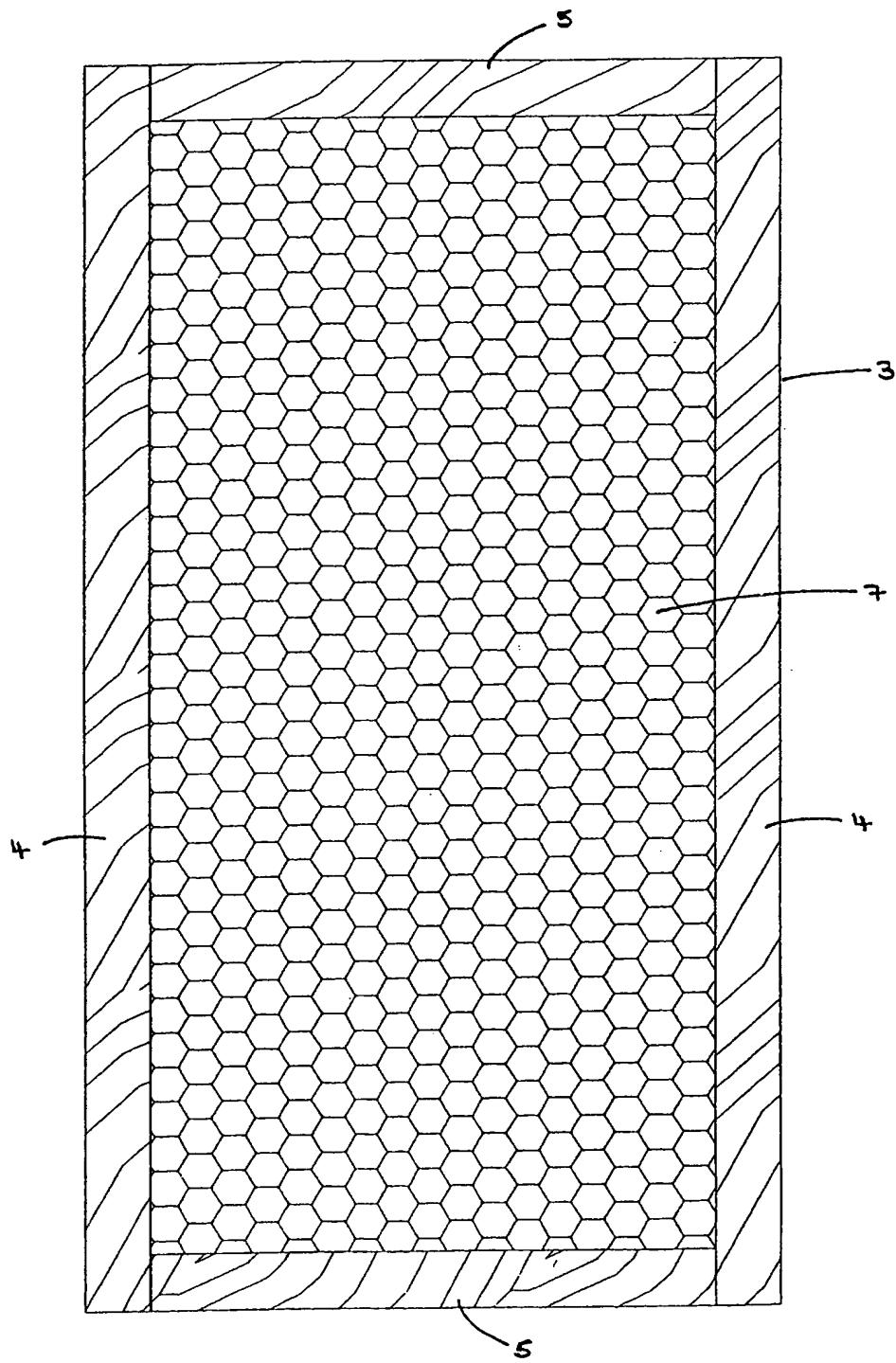


FIG. 2

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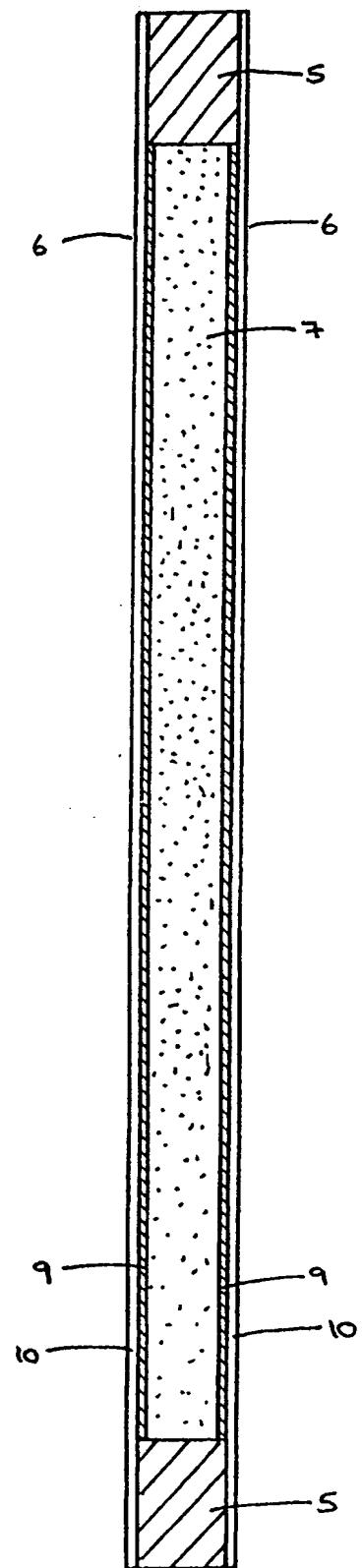


FIG. 3

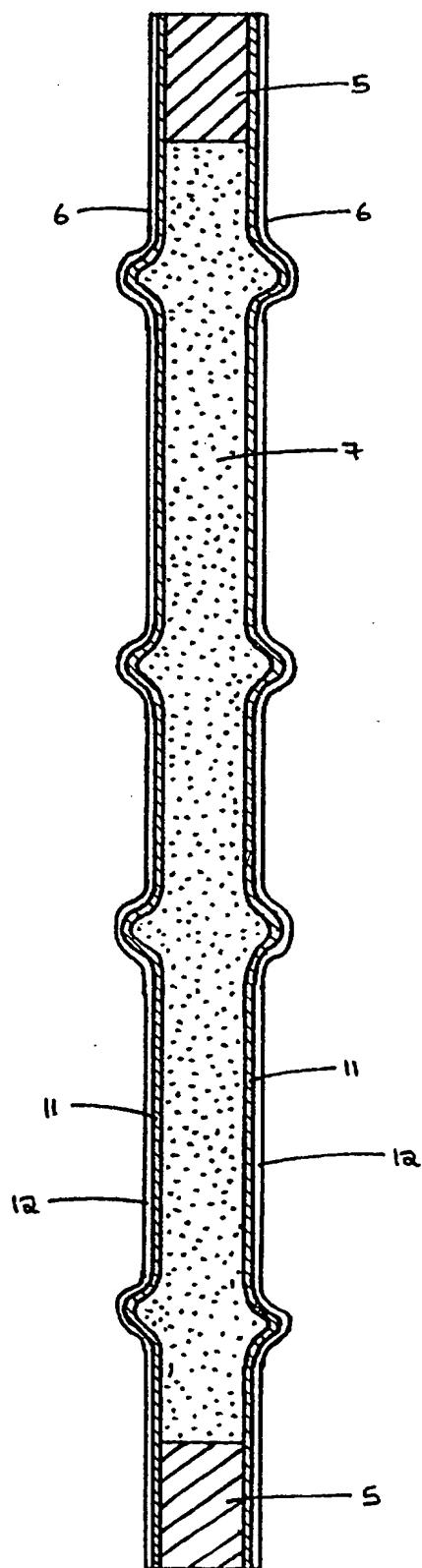


FIG. 4

DOORS AND DOOR ASSEMBLIESField of the invention

5 This invention relates to door leaves and their component parts, and to door assemblies incorporating the door leaves.

Background to the invention

10 A door assembly comprises a door leaf mounted in an outer door frame. A door leaf is often made up of a perimeter frame (sometimes called a sub-frame) supporting, and usually sandwiched between, a pair of outer panels or skins which form the front and back faces of the leaf. The frame and panels together define an internal chamber which is typically filled with an insulating material. A typical rectangular frame is made up of two "rails", forming in normal use its top and bottom edges, and two "stiles" which form its side edges.

15  
20 The frame and the outer panels can each be made of a variety of different materials. As a common example, the frame may be made of timber and the panels of a thermoplastic material such as PVC-U or (where greater security or fire resistance is needed) a metal such as steel.

25 Increasing resistance to damage, for instance from an attempted break-in, is continuously being required of commercially available door leaves, particularly through the introduction of more stringent industry standards.

30 It is possible that the outer panels of many conventional

door leaves, whether made of plastics or metals, will be unable to provide the security required of them; improvements in construction are therefore desirable.

Aspects of the present invention relate to  
5 improvements in door leaves, particularly in the construction of their outer panels and particularly for the purpose of improving strength and security.

10 Statements of the invention

According to a first aspect of the present invention there is provided a door leaf comprising a frame supporting front and back outer panels, wherein at least one of the outer panels comprises two adjacent layers, 15 one of a metal and the other of a non-metal.

The use of a multi-layer, composite outer panel can improve the strength and overall security of a door leaf. The metal layer can provide improved performance under penetrative tests, as compared to a solely non-metallic 20 (eg, plastics) panel. The non-metal layer (in particular a plastics layer) can allow improved resistance to impact damage and denting, compared to a purely metal panel, but without the cost and weight disadvantages associated with simply increasing the thickness of a plain metal panel.  
25 Each of the two layers provides additional support and strength to the other, the panel as a whole benefitting from the advantageous properties of both constituent materials.

Preferably both the front and the back outer panels 30 are multi-layered. Either or both may of course comprise

additional layers of other suitable materials.

The metal layer may be made of, for instance, steel (eg, galvanised steel) or aluminium. It may comprise a solid metal sheet or a mesh or be in any other appropriate form.

5           The non-metal layer may be made for instance of a plastics material, MDF (medium density fibreboard) or another fibrous material, timber or a timber-based material (such as a laminar timber composite or other engineered timber). It is preferably made of a plastics material, which may be any suitable plastics material having appropriate strength, rigidity and other physical characteristics required of an outer door panel. Many suitable materials are already known - they include PVC-U, ABS (acrylonitrile butadiene styrene) or ASA (acrylate styrene acrylonitrile) or a combination thereof, GRP (glass-reinforced plastics) materials and FRTs (fibre-reinforced, for instance carbon fibre-reinforced, thermosets).

10          Both layers may be made, and secured to the frame where appropriate, using conventional techniques as would be applied to single-component door panels.

15          Preferably, although not necessarily, the non-metal layer is positioned externally and the metal layer internally. The two layers may be secured together in any appropriate manner, for instance by means of a suitable adhesive. Alternatively, they may be held adjacent one another simply because of their construction and that of the door frame which supports them. For 20         instance, instead of both layers being made to the same

size, the internal layer may be sized to fit just inside the frame, whilst the external layer is slightly larger and sits at least partly over the external face of the frame.

5       The frame of the door leaf may be made of any material, including timber, a timber-based material or a synthetic material such as a thermoplastics material, a glass-reinforced plastic or a fibre-reinforced thermoset.

10      The frame will typically be a four-sided perimeter frame of rectangular construction having two stile and two rail components connected together at the four corners. However, other shapes of door frame may still be used in the present invention.

15      The frame and outer panels will together define an internal chamber, which may be filled with for instance a thermally insulating and/or fire retardant material. Suitable materials include polystyrene and polyurethane foams, which may be injected into the chamber or may comprise pre-formed or pre-cut sheets or blocks  
20      positioned (and preferably glued into place) between the outer panels. One typical example of a suitable filling material is that available as "Foamstrand" (trade mark), a foamed polyurethane containing reinforcing strands.

25      In conventional fashion, the outer panels may be shaped and/or textured (for instance to simulate wood grain), and/or coloured, coated, decorated, etc... They may be pre-formed to provide the desired shaping and/or texturing, or it may be produced during assembly of the door leaf, for instance by pressing the panels onto  
30      appropriately shaped blocks of filling material

positioned within the frame.. Shaping may protrude from the external surface of the door leaf and/or be sunk below it. The two layers of an outer panel may be formed separately to the desired shape, or alternatively one may be pre-formed and then used to form the appropriate shaping onto the second.

Each of the two layers, but especially the external one, may be provided with one or more appropriate coatings, imparting desired cosmetic and/or mechanical properties.

The outer panels may be secured to the frame for instance by glueing, and/or (as in many known door leaves) by means of interengaging parts such as edge lips on the panels engaging in grooves in the frame.

The door leaf may carry conventional fittings and/or door furniture, examples being fasteners and handles, locks and keyholes, hinges and letterboxes. It may include one or more glazed panels, which can be formed in it in conventional manner.

According to a second aspect of the invention there is provided a panel for use as an outer panel in a door leaf according to the first aspect, the panel comprising two adjacent layers, one of a metal and the other of a non-metal, as described above.

The invention also provides, according to a third aspect, a door assembly incorporating a door leaf in accordance with the first aspect and an outer door frame. A fourth aspect provides a process for making the door leaf or door assembly by assembling their constituent elements in the manner described above.

The present invention will now be described, by way of example only, with reference to the accompanying illustrative drawings.

5       Brief description of the drawings

In the drawings, which illustrate a door assembly and door leaf in accordance with the invention:

Fig 1 is a front view of the assembly;

10      Fig 2 is a simplified front view of the door leaf, with the outer panels removed;

Fig 3 is a section along the line III-III in Fig 1, omitting the outer door frame for clarity; and

15      Fig 4 is a section analogous to that of Fig 3, through an alternative door leaf, in accordance with the invention.

Detailed description

The door assembly shown in Fig 1 includes a door leaf 1 hung in a conventional outer frame 2. As seen in Figs 2 and 3, the door leaf comprises a rectangular perimeter frame 3 made for instance of wood. The frame is made up of two (vertical, in normal use) stile components 4 and two (horizontal) rail components 5, connected at their four corners in conventional manner.

25      The frame is adhered to front and back outer panels 6. The frame and panels together define an internal chamber 7, which is filled in conventional fashion with, in this case, an injected polystyrene foam to provide thermal insulation and additional support for the panels.

30      Although a handle 8 and hinges 13 are shown mounted

on the door leaf in Fig 1, in general additional elements such as locking mechanisms, hinges, shaping and texturing of the outer panels, glazed lights and other door furniture, all of which may be provided on a door leaf in accordance with the invention, have been omitted from the figures for clarity.

Each of the outer panels 6 is made up of two adjacent layers of different materials, in the case of the Fig 3 leaf an internal layer 9 of a metal such as steel and an external layer 10 of a non-metal such as a carbon fibre-reinforced thermoset. In the Fig 3 leaf the internal layer 9 is cut slightly smaller (in terms of the area of its front face) than the external layer 10; the internal layer thus fits just within the perimeter frame 3 whilst the external layer sits on top of it. This sizing alone is generally sufficient to hold the two layers in place adjacent one another, although a suitable adhesive may be applied between them for additional security. The external layer 10 is glued to the perimeter frame 3.

The outer panels of the Fig 4 door leaf each comprise an internal non-metal layer 11, pre-formed to a desired shape, adhered to an external metal layer 12, similarly pre-formed. In this case both layers are cut to the same size, and the assembled two-layer panels are glued to the perimeter frame.

Each of the door leaves illustrated may be sold separately or, in combination with an outer door frame in which it is or may be hung, as part of a complete door assembly as shown in Fig 1.

CLAIMS

1. A door leaf which has a frame supporting front and back outer panels, wherein at least one of the outer panels comprises two adjacent layers, one of metal and the other of non-metal.  
5
2. A door leaf according to claim 1 in which both outer panels are multilayered, each said panel comprising one metal layer and one non-metal layer.  
10
3. A door leaf according to claim 1 or claim 2, in which on each non-metal layer is positioned externally and the metal layer is positioned internally.  
15
4. A door leaf according to any of the preceding claims in which the front and back outer panels together with the door frame define an internal chamber.
- 20 5. A door leaf according to claim 4 in which said internal chamber is filled with a thermally insulating or fire retardant material.
- 25 6. A door leaf according to any one of the preceding claims in which the metal layer is made of a steel material
7. A door leaf according to any one of claims 1 to 5 in which the metal layer is composed of aluminium.  
30
8. A door leaf according to any one of the preceding claims in which the metal layer is in the form of a mesh.
9. A door leaf according to any one of the preceding

claims in which the non-metal layer is of a plastic material.

10. A door leaf according to any one of the preceding  
5 claims in which said layers are held together by an adhesive.

11. A door leaf according to any one of the preceding  
claims in which the internal layer fits within the frame,  
10 and the external layer extends at least partly over the  
external face of the frame.

12. A door leaf substantially as herein described with  
reference to and as illustrated in Figs 1 to 3, or Fig 4  
15 of the accompanying drawings.

13. A door assembly having a door leaf according to any  
one of the preceding claims.

20 14. A kit of parts for a door leaf comprising a frame  
and two outer panels for the front and back of the door  
but respectively, wherein at least one of the outer  
panels comprises two adjacent layers, one of metal and  
the other of non-metal.

25 15. A process for making a door leaf comprising  
attaching a front outer panel and a back outer panel to a  
frame, at least one of said outer panels having two  
adjacent layers, one of said layers being of metal and  
30 the other of an non-metal.

16. A process according to claim 15, including inserting  
a first layer of said panel into said frame and attaching  
a second layer of said panel to the exterior of said

frame such that it is in contact with said first layer.

17. A process for making a door leaf substantially as herein described with reference to the accompanying drawings.

5



Application No: GB 9908910.4  
Claims searched: 1 - 17

Examiner: David Hotchkiss  
Date of search: 10 August 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): E1J (JGS, JGL)

Int Cl (Ed.7): E06B (3/70, 3/72, 3/74, 3/76, 3/78, 3/82, 5/16)

Other: Online: WPI, EPODOC, JAPIO

### Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2161196 A	(Svensk Dorreteknik AB) figure 1 and layers 12 - 16	1 - 7, 9, 10, 14 & 15
X	GB 1240507 A	(Badische Anilin- & Soda-Fabrik Aktiengellschaft) figures 1 & 2, layers 5,6 & 7 and column 2, line 49	1, 2, 4, 6, 7, 9, 10, 14 & 15
X	US 4282687 A	(Jacmeer Nominees Pty. Ltd.) figure 3 layers 20 & 26 and column 2, line 60	1, 2, 4, 5, 6 & 10
X	EP 0103048 A	(Turenfabrik Brunegg AG) English abstract and figure 1	1 - 5, 7, 9, 10, 11, 14, 15 & 16
X	FR 2570118 A	(Blocfer SA) English abstract and figure 1	1 - 4, 9, 10, 14 & 15

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